

satisfactory vision. It will soon be seen to what extent irradiation increases the apparent diameter. What is left of irradiation in daylight, may be eliminated when the law is determined which connects the phenomenon of irradiation with intrinsic brightness and the effect of additional light on the retina.

"If measures of *Venus* point out any defect in a telescope and the law of that defect, the rule so obtained will apply to all other measures of the moon, planets, &c., by the same person with the same telescope. And if such an inquiry does not lead to consistent results, it would seem to follow that there are in telescopes errors other than we have been accustomed to suspect, and obeying different laws."

"The great intrinsic brightness of *Venus* and her manageable diameter make her far fitter for experiments on irradiation than the sun or moon, which can only be compassed by a heliometer."

*Observations of Solar Spots at Mr. Lawson's Observatory, Bath.*  
By Mr. E. J. Lowe.\*

"As the solar disc during the last few days has exhibited some remarkable phenomena, I send an abbreviated account made with the 11-foot refractor; several powers were used, but 55 was the usual one.

"The spots are distinguished as B, C, and A, and their relation to the centre of the sun is expressed by co-ordinates through his centre, *a* above, *b* below, *r* right, *l* left. When a spot is near the edge it is more convenient to refer it to the edge, and the word *edge* means that the spot is as far from the edge as the figures denote. The direction refers to the sun as seen in an inverting telescope. The figures and fractions are in digits and fractions of a digit."

\* In reply to some inquiries, Mr. Lowe informed the Editor that observations of solar spots at the Bath Observatory are made thus:—A reticule of small squares is used as a micrometer, each interval being, very nearly, half a digit, or  $\frac{1}{24}$  of the sun's diameter. These spaces, which are about  $80''$ , are, in the language of the Bath Observatory, each called  $7^\circ$ , *i. e.* supposing the sun's diameter about  $180^\circ$ . The mode of registering the observations is very simple and neat. For every observation there is an engraving, in which the reticule wires are represented and numbered, so that when the sun is brought into its proper place in the telescope, each spot is referred at once to its own square in the drawing. For details, a larger system of squares is engraved below the reticule; in these the remarkable spots are carefully drawn, and referred to their proper places by letters. Mr. Lawson's telescope has 7 inches aperture (a very fine glass by Dollond), and is equatorially mounted, with clock-work. The position of the spots is noted with a power of 55 applied to *Lawson's Solar Eyepiece*, which takes in the whole image of the sun; the details are completed with other powers. There is, besides, a 5-foot telescope on a stand, with a vertical and horizontal motion. Mr. Lawson has sent 10 drawings on days referred to in this paper.

	Bath M. T. h m	B.	C.	A.
Feb. 23	o o	$1\frac{3}{4}$ a	$2\frac{3}{4}$ b, $\frac{3}{4}$ r	
24	1 30	$2\frac{1}{2}$ a, $\frac{1}{4}$ r	$1\frac{3}{4}$ b, $\frac{3}{4}$ l	5 edge.
25	2 30	$3\frac{1}{4}$ a, $\frac{1}{4}$ l	$\frac{3}{4}$ b, $1\frac{3}{4}$ l	$5\frac{1}{2}$ b, $\frac{1}{4}$ edge.
25	23 30	$3\frac{1}{2}$ a, 2 l	1 b, 2 l	4 b, 1 edge.
27	o o	4 a, $3\frac{1}{2}$ l	$\frac{1}{2}$ b, $3\frac{1}{3}$ l	3 b, $\frac{1}{4}$ l
28	22 o	3 a, $\frac{1}{4}$ edge.	$\frac{3}{4}$ b, 1 edge.	
March 1	23 30	Disappeared.	$\frac{3}{4}$ a, $\frac{1}{2}$ edge.	$1\frac{3}{4}$ b, $\frac{1}{4}$ r

" 1849, February 23, 0<sup>h</sup>. A very large spot, the *umbra* of which was  $\frac{1}{2}$  digit in length and  $\frac{1}{3}$  in breadth, surrounded with much *penumbra*, was situated with its lower edge  $1\frac{3}{4}$  digits perpendicularly above the sun's centre (inverted eye-piece); this, for distinction's sake, we shall call B; also a mass of *penumbra* (C, with no large *umbra*) of  $1\frac{1}{2}$  digits in length, and  $\frac{3}{4}$  in breadth, about  $2\frac{3}{4}$  digits perpendicularly below the sun's centre, and  $\frac{3}{4}$  to the right. There were other smaller spots and clusters. The corrugations were very strong, and extended more or less all over the sun's disc, being most marked in the E. and W.

" Feb. 24, 1 $\frac{1}{2}$ h. The spot B had not moved with the rotation of the sun, but had retrograded  $\frac{1}{4}$  digit, it is  $2\frac{1}{2}$  digits above the sun's centre. The mass C had moved with the motion of the sun. At 5 digits below the centre of the sun, a notch of  $\frac{1}{2}$  digit in length was cut out of the edge of the sun. In an hour's time the notch had sensibly increased. Clouds prevented further observation.

" Feb. 25, 2 $\frac{1}{2}$ h. The indentation in the edge of the sun has disappeared, but a spot A, of great dimensions, is situated  $\frac{1}{4}$  digit from the sun's edge, which accounts for the notch seen yesterday.\* The motion of the spot B is again direct. C is becoming less dense.

" Feb. 26, 1 $\frac{1}{2}$ h. A remarkable occurrence with respect to the spot B took place; it was first noticed by Lieut. Hardy, who called my attention to it. The *umbra*, which was of an elongated form, opened in the centre, and so divided it into two parts; it always opened from the lower edge, and was alternately open and closed at intervals of 15°; this was very sensible, and the experiment of marking the time which elapsed between the openings was repeated many times. The *penumbra* did not change its form. A is a fine single spot.

" Feb. 27, 0<sup>h</sup>. Spot B had divided into two spots at that part where the partial openings were yesterday, and the lower spot of the two had become smaller. At 0<sup>h</sup> 10<sup>m</sup> it was noticed that this

\* "I find the following entry in Mr. Lawson's observatory-book:—'Camberwell, 1846, June 30. Viewed the sun through the fine achromatic just completed by Mr. Dollond, of 12 inches clear aperture. (The whole aperture was used by means of 'Lawson's Solar Eye-piece.') Saw the limb of the sun notched. In about two hours the notch or indentation had disappeared, and a large spot was visible. All agree as to the appearance of the notch on the limb of the sun; powers used were 70 and 150. Signed, G. DOLLOND, G. HUGGINS, and H. LAWSON.'"

smaller spot also opened from beneath in the way that the whole spot had done yesterday, only those openings took place every minute, remaining open from 5<sup>s</sup> to 8<sup>s</sup> of time. These separations were observed ten times during as many minutes, when this phenomenon ceased at this part of the spot, but the division between the spots now alternately enlarged, and partially closed, at intervals of a minute, remaining widely open each time from 5<sup>s</sup> to 8<sup>s</sup>. At several periods the two spots appeared to overlap each other, for they joined, and the edge of the smaller spot was indented. At 0<sup>h</sup> 30<sup>m</sup> the oscillations were abating; clouds came over. The spot A had also become divided since yesterday, and shewed signs of a further division, for in the lower of the two spots were two indentations, the one above and the other beneath. 1<sup>h</sup> 7<sup>m</sup>. Again sunshine. The lower spot in A divides at intervals of 30<sup>s</sup>, and closes again. There was also thought to be a light flowing from behind the *penumbra* at the upper edge."\*

*Extract of a Letter from W. S. Jacob, Esq. inclosing two Sheets of Diagrams of Solar Spots observed at Poona, in December 1848, and January and February 1849.*

"I beg to call your attention to a remarkable phenomenon that I do not remember to have seen or heard of before, viz. an *annular* spot, which was seen on the 1st of February: it is marked *a* in the diagram of that date, and I have also sketched it on the margin on an enlarged scale: the dark spot was of an irregular pentagonal shape, with a bright speck not quite in the centre. I had a suspicion of a filament uniting it to the side of the penumbra, but the power of my instrument (a 3½ feet) was insufficient to verify this. A similar phase has this day appeared in another spot, which will be shewn in the next sheet."

Captain Shea exhibited a book, "containing daily observations of the spots which pass over the sun's disc, taken with a three-foot telescope, by Carey." There are four rows of circles in each page, and the book, if complete, would shew a picture of the disc on every day when the sun is visible. The corresponding days in each year are under each other. Captain Shea says his drawings prove "that spots which disappear on the thirteenth day do *not* reappear on the thirteenth day afterwards, and that they cannot be considered as fixtures."

On the 9th and 10th of last November, Captain Shea "clearly

\* The circumstance of streams of light crossing solar spots was seen by Mr. Lawson the day of the solar eclipse of May 15, 1836, in a spot whose *umbra* was of the shape of the ace of clubs, only the *penumbra* in this case was not of usual aspect, but resembled flocculent clouds. The streams of light closely resembled coruscations of *aurora borealis*. The *umbra* of this spot was 10080 miles in diameter, and the surrounding shade 32200 miles.